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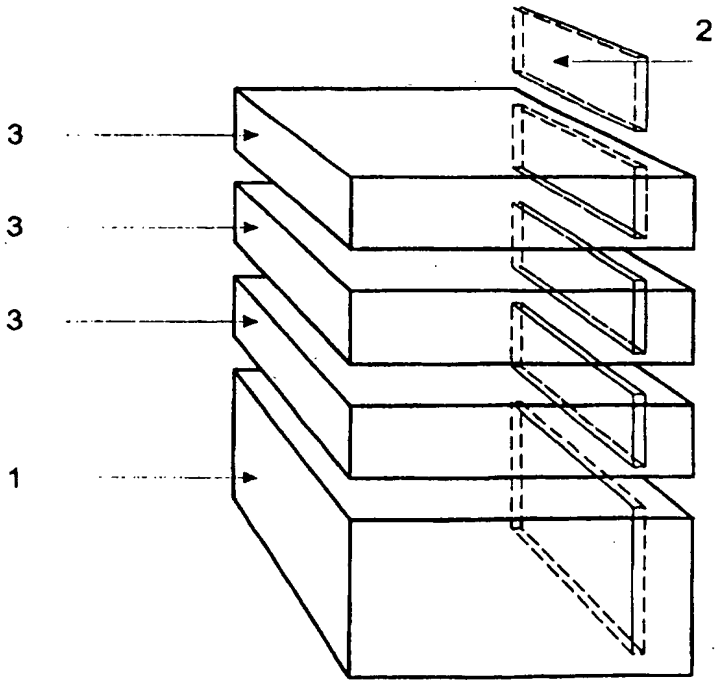
(57) Abstract

A computer installation having a modular digital architecture (MDA) comprises a universal base module (UBM) (1) and one or more functional upgrade modules (FUM) (3) detachably connectable to the UBM (1) by a modular upgrade bus (MUB) (2). The MUB (2) comprises a respective bus link within each module (1, 3) such that, when the modules (1, 3) are connected together, the bus links of the modules are connected in series to form the digital MUB which includes sub-buses for supply of power to the modules and transfer of control and data signals therebetween. Such an MDA can be used to produce a wide range of systems using the same basic architecture, such as a network computer (NC), a personal computer (PC) incorporating FUM's providing various PC features, such as an enhanced processor, a CD ROM drive, a hard disk drive, etc., or an appliance computer (AC) incorporating FUM's providing a range of appliance functions for the home, office or classroom, such as an audio system, an interactive television system, an office telephone system, a home security system, etc.. Furthermore the system permits straightforward FUM replacement or upgrade by addition of further FUMs without requiring any particular technical expertise.



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"Modular Digital Computer Installations"

This invention relates to modular digital computer installations.

Personal computers (PC's) are widely used in a home environment, and such computers commonly comprise a processing unit, a monitor and a keyboard, as well as one or more peripheral devices, such as a printer, a hard disk drive, a floppy disk drive and a CD ROM drive. However such computers are difficult to install and upgrade, rapidly become obsolete, are expensive to maintain and are difficult or impossible to connect to other home/office appliances, such as telephones, telefax machines, answering machines, televisions, video recorders, hi-fi systems, home security systems etc. These problems limit the appeal of PC's to non-technical users. As a result, more than 60% of households in the USA and 80% of households in Europe do not own a PC.

It is an object of the invention to provide a computer installation having a modular digital architecture which renders it straightforward to customise the installation to user requirements and for connection to other home/office appliances whilst additionally enabling the installation to be simply expanded and upgraded.

The invention is defined by the accompanying claims.

The provision of the modular digital architecture (MDA) in the installation

of the invention provides a flexible design which can be applied to any digital appliance in the home, office or classroom. The installation is designed to comprise three main components, namely a universal base module (UBM), one or more functional upgrade modules (FUM) and a modular upgrade bus (MUB) for interconnecting the modules in such a manner as to allow for supply of power thereto and transfer of control and data signals therebetween.

The UBM may be a common digital module based on MDA for supplying any information appliance based on MDA, such as a PC, a home audio system, an office telephone system, etc. Furthermore the UBM on its own may constitute a basic entry level PC or network computer (NC) (incorporating a processor and a modem/network interface for connection to the Internet/Intranet). The UBM will typically incorporate a power supply, a graphics interface (with TV and SVGA capability), an audio system and basic input device functions, for a keyboard, mouse and joystick, for example. In certain applications the UBM may also include any of a low-cost processor, a floppy disk drive, a hard disk drive, a modem and a network interface for example. The MUB provides the backbone of the MDA and may carry power, inter-module communication data, digital audio and video, telephony signals and system monitoring/control functions. Whilst the MUB is preferably designed in modular form to allow for easy expansion and upgrade by a non-technical user, it could also take other physical forms as described hereinbelow. The MUB may provide inter-module communication by way of industry standard buses such as PCI, ISA, E-IDE, IIC, EVC, USB, AGP and 1394 with spare capacity to add any new industry standard

bus in the future, in order to ensure that the MDA is adaptable to future technologies.

The FUM are capable of providing a multiplicity of added features when connected to the UBM in order to create a specific appliance, such as a standard PC, a NetPC, an audio/video system, a home security system, a games console, etc., or in order to create a multipurpose appliance. The modules may provide any combination of a processor (possibly of higher performance than a processor provided within the UBM), a floppy disk drive, a hard disk drive, a CD ROM drive, a modem, a TV/FM tuner, a graphics interface, an audio system, a digital video system, a digital satellite system, an office phone system (PBX), a network interface, etc.

Such a system enables a computer installation to be assembled or upgraded directly by the user in a particularly straightforward manner without requiring the services of an expert and without the user having to open any module casings or make any complex cable connections requiring special expertise. All that the user needs to do is to connect the modules together by means of the bus system in the required order and to then apply power to the system so as to cause the system to be automatically configured. Such automatic configuration is preferably arranged to take place regardless of the order in which the modules are connected together.

In order that the invention may be more fully understood, reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1 to 4 are explanatory diagrams showing an installation of the

invention;

Figures 5 and 6 diagrammatically show the UBM of the installation;

Figures 7 to 10 diagrammatically show the MUB of the installation;

Figure 11 diagrammatically shows the FUM of the installation;

Figures 12, 13 and 14 show possible combinations of modules in such an installation;

Figure 15 is a schematic diagram illustrating the layout of the software driving the installation;

Figures 16 to 19 show typical pin layouts in a detailed implementation in accordance with the invention; and

Figure 20 is a block diagram of a computer installation in accordance with the invention.

The computer installations based on a modular digital architecture (MDA) in accordance with the invention which will now be described with reference to the drawings may serve a number of functions, including the function of a so-called home/office bus system for linking together a number of appliances in a home/office environment which do not conform to the same standards, such as a television receiver, a hi-fi system, a video recorder, a personal computer, a telephone, a heating control, etc. Such appliances would not normally be able to communicate with one another or be controlled by a common interface because each communication device has its own power supply, control system and communication standard. However, as will be described in more detail below, a home/office bus system may be provided to connect

together a plurality of device modules performing these functions and a common control and/or a power supply module, all of which are individually cased and are designed to be connectable together so that the user can assemble the modules as required and can interchange and upgrade modules where necessary, including the control and/or power supply module if required, without any need for specialist technical knowledge. The modules may be connectable together in the manner of a hi-fi stack by means of the bus system so as to be powered by a single power supply unit and controlled by a single control unit which may for example be a computer keyboard and/or a remote control unit.

Figure 1 diagrammatically illustrates the interconnection of a universal base module (UBM) 1 and a plurality of functional upgrade modules (FUM) 3 by means of a modular upgrade bus (MUB) 2 incorporating six sub-buses which together transmit all the data formats required by the modules. More particularly a first sub-bus transmits power signals from the UBM 1 to each of the FUM 3. Second and third sub-buses are provided for standard ISA communication and fast PCI communication, and a fourth sub-bus is provided for enhanced IDE data communication between the modules. A fifth sub-bus serves for bidirectional transfer of control signals between the modules utilising IIC protocol. A sixth sub-bus serves to transmit audio signals between the modules where required. Additional sub-buses may be provided where required to control secondary functions, for example for transfer of radio communication control signals or infra-red control signals for controlling radio communication or infra-red modules.

As will be more particularly appreciated from Figure 2 the universal base module (UBM) 1 preferably constitutes the bottom module of the stack to which any combination of functional upgrade modules (FUM) 3 may be added one on top of the other where required to upgrade or add additional features to the installation. Furthermore, as shown more particularly in Figure 3, the modular upgrade bus (MUB) 2 comprises a series of bus links 10, each bus link 10 constituting a respective part of one of the modules 1, 3 and the bus links 10 being connectable together in series when one or more functional upgrade modules (FUM) 3, as shown in Figure 4, are stacked on top of the UBM 1.

Figure 5 diagrammatically shows the internal components of the UBM 1 comprising a power supply unit 4, an optional faxmodem/network interface 5, an optional floppy disk drive 6, an optional hard disk drive 7 and an optional processor board 8, in addition to the bus link 10. As shown diagrammatically in Figure 6, these components are accommodated within a casing 20 provided with a lockable cover 9. The cover 9 is designed to be lockable in position after assembly, for example by special screws or rivets, in order to prevent access to the inside of the casing by the user.

It should be appreciated that it is not necessary for all the modules to be connected to all the sub-buses. Thus for example, one of the FUM 3 may be connected to the fast communication sub-bus, whereas another of the FUM 3 may be connected to the standard communication sub-bus. Furthermore only one of the FUM 3 may be

connected to the data communication sub-bus, whereas the MUB 1 may be connected to all of the sub-buses. Also the bus system may be split into two channels, namely a standard channel and a fast channel, which are provided respectively on the left hand side and the right hand side of the assembly for communicating signals to modules below and above a processor FUM, as will be described in more detail below.

Figure 7 diagrammatically illustrates the connecting together of the UBM 1 and the FUM 3 by means of the bus links 10 which are connectable to the main board 18 of a processor FUM 3 by means of plug and socket connectors and which form integral parts of the modules. In the particular implementation illustrated the main board 18 is provided with right hand and left hand bus sockets 13A, 13, the right hand socket 13A receiving an enhanced bus board 14 and the complete assembly being surrounded by a casing 16. Furthermore a lower FUM 3 incorporates an integral standard bus link 10 comprising a socket 13, a standard bus board 12 connected to the socket 13 and a socket 15 (see Figure 11) by means of which the associated device unit 17, e.g. a hard disk unit, is connectible to the standard bus board 12. This assembly, within its casing 16, is connectible to the processor FUM 3 by engagement of the upper part of the standard bus board 12 within the left hand socket 13 on the main board 18. Similarly an upper FUM 3 is provided with an integral enhanced bus link 10 comprising an enhanced bus board to which the associated device unit, e.g. a television receiver, is connected by a socket (not shown) and to the lower part of which a socket 13 is connected for detachable connection of the upper FUM 3 to the processor FUM 3 by means of the engagement of the enhanced bus board 14 on the right hand side of

the processor FUM 3 within the socket 13 of the upper FUM 3.

It will be appreciated that, in this implementation all modules which require an enhanced bus connection will need to be positioned above the processor FUM 3 and to be interconnected by way of serial connection of the enhanced bus links 10 on the right hand side of the stack, whereas all the modules requiring a standard bus connection will need to be positioned below the processor FUM 3 and to be interconnected by serial connection of the standard bus links 10 on the left hand side of the stack, as shown in Figure 7. In each case the socket 13 projecting from the bottom of each module is engageable within a socket enclosure 19 in the top of the immediately preceding module within the stack. The bus system may comprise tracks for 480 signals divided into two main streams, namely a PCI-based stream going up and an ISA-based stream going down, adjacent bus links being connected to one another by two 32-bit PCI connectors and a PCB edge connector to provide mechanical stability, reliable insertion/removal, high bandwidth and low cost connectivity. Further the UBM 1 may incorporate a power supply, a graphics interface, an audio interface and basic input device functions, and also, if required, additional device units, e.g. the hard disk drive and/or floppy disk drive. When the individual modules have been plugged together and the installation has been switched on, the installation is automatically configured, the particular order in which the modules are stacked being immaterial provided that connections are made to the required buses.

As regards the physical implementation of the MUB, various possible

alternative implementations will now be described with reference to Figures 8, 9 and 10. In the implementation of Figure 8 the MUB comprises a series of bus links 10 each of which is constituted by a number of track parts arranged in parallel, that is one track part for each appropriate sub-bus. Furthermore each bus link 10 is a part of one of the modules, and each link 10 has a plug connector at one end and a socket connector at the other end. A similar implementation is shown in Figure 7 except that, in that case, which is the preferred implementation, the processor FUM has separate links 10 provided on the left hand and right hand sides of the module for the two channels communicating with modules below and above the processor FUM. In both cases the complete bus system is formed by serial connection of the links 10 within the various modules by stacking of the modules one above the other so that the plug on each module engages within the socket of the unit immediately below it to provide serial connection of the links.

In the implementation of Figure 9 the MUB is a single continuous PC board 10A which is separate from each of the modules and which may also be separately cased. Furthermore the board 10A is provided with a number of electrical socket connectors spaced along its length into which complementary connectors on the modules may be plugged. If required the board may be replaced by a flexible ribbon.

In the implementation of Figure 10 the MUB consists of a number of U-shaped connector or ribbon links 10B having two ends provided with connectors which are separately attachable to and detachable from two of the modules so that a plurality

of such links may be utilised for linking all the modules together in series. As before all the links 10B interconnecting the modules, considered together act in a similar manner to the continuous board to provide the required intercommunication between the modules.

Figure 11 diagrammatically shows the internal components of a number of FUM 3a, 3b, 3c and 3d, each of which has a casing 16 and an internal bus link 10 in the form of a MUB board, as well as one or more further internal components. The module 3a houses an industry standard PCI upgrade card 17A whereas the module 3b houses a custom designed board such as an upgrade processor board 18. The module 3c houses a 5.25" drive unit such as a CD ROM player 17A, and module 3d houses a number of I/O cards 19.

Several examples of computer installation which may be produced using the modular digital architecture (MDA) will now be described with reference to Figures 12, 13 and 14. Figure 12 shows a network computer 20 (NC or NetPC) consisting of a UBM 1 fitted with a lockable cover 9. This may be termed a NeoNC and provides a basic installation with a built in processor and faxmodem/network interface for connection to the Internet/Intranet. Furthermore the NeoNC is upgradable to a modular PC utilising one or more FUM (after removal of the lockable cover). Figure 13 shows a modular personal computer 21, which may be termed a NeoPC, comprising a UBM 1 and a number of FUM 3 forming an interconnected stack with a lockable cover 9 being fitted to the uppermost FUM 3 in the stack. The lockable cover 9

provides mechanical and electrical safety and security. The NeoPC comprises any combination of PC devices, such as a processor, a hard disk drive, a CD ROM drive, a faxmodem, a graphics interface, an audio interface, etc. Additionally or alternatively the MUB 1 and FUM 3 may be interconnected to form an appliance computer 22 (AC) as shown in Figure 4, which may be termed a NeoAC, for providing a range of features for the home, office or classroom, such as an audio system, an interactive television system, an office telephone (PBX) system, a home security system, etc. It is particularly advantageous if the modules of such an installation are mechanically locked together such that the installation can only be disassembled in a particular sequence of steps, the first step of which involves the removal of the lockable cover 9. It is also advantageous if the installation incorporates a safety system to electrically disable the installation if the UBM 1 or an FUM 3 is opened by removal of the cover 9. Furthermore a safety system may be incorporated to prevent damage to the installation which might otherwise be caused by plugging of a non-compliant FUM into an existing installation.

Further features which are preferably provided in a computer installation in accordance with the invention are as follows. Each FUM may be adapted to supply data on the viability of the upgrade status of the MDA to the processor within the UBM or upgrade processor FUM. Furthermore a feature may be included to warn the user if any system parameters have been exceeded, such as the power supply capacity, the number of hard drives, the number of FUM added, etc. The power control features may include features to minimise the power consumed by the installation at all times,

particularly during periods of inactivity, and may provide visual indications of the various power saving modes. A thermal management feature may also be included to minimise the risk of damage in the event that any module within the installation overheats, the damage limitation being achieved by warning the user, cutting off the power or both of these. The flexibility of the MDA may enable up to eight ISA and seven PCI upgrade modules to be connected simultaneously, which compares favourably to the maximum number of ISA/PCI upgrades permitted in any conventional PC which is typically seven or less.

Figure 15 is a schematic layout of a typical software interface for driving such a system in which appropriate buttons and icons are provided representing four families of modules, namely personal computer devices, which covers hard disk drive, floppy disk drive, printer, tape drive, CD ROM drive, scanner and various I/O adapter cards; communication devices, which covers telephone, telefax, modem, answering machine, ISDN and conferencing; entertainment devices, which covers television, cable, radio, hi-fi, video, video on demand and games; and house automation devices, which covers light, heating, security, kitchen, air conditioning and other devices. By clicking on a button, using a mouse or keyboard, a menu of options will appear on a monitor permitting the user to interact with the device unit. For example, by clicking on the CD ROM button, the user will be presented with options such as open, save, play, format and configure.

The control unit serves to implement control of the individual modules and

the power supply unit by means of appropriate instructions transmitted from the control unit to the modules and power supply unit. The control unit has three main functions, namely (i) the controlling of the various units, (ii) the management of communications to and from each unit, and (iii) the determination of the overall system performance and speed. Furthermore the control unit incorporates the central processing unit (CPU) which may process signals received from the modules and send back signals to the modules as a result of such processing.

Figures 16 and 17 show a typical pin layout of the standard channel as provided on the left hand side in the arrangement of Figure 7 in which the units are plugged together by plug and socket connector arrangements, e.g. a PCB edge-mount connector and two 32 bit PCI connectors. Figures 18 and 19 show a typical pin layout of the enhanced channel as provided on the right hand side in the arrangement of Figure 7. The pin layout is split into two main channels, namely a standard channel (power, standard ISA communication, enhanced IDE data, IIC control and audio), and a fast channel (power, fast PCI communication, enhanced IDE data, IIC control and audio) so that the lengths of the signal transmission paths can be kept to a minimum, and so that the number of signals in each channel can be kept to a reasonable level. The pin layout and associated wire interconnections provide for communication of typically more than 280 signals in the various data formats, such as power, audio, video, data, control etc.

Figure 20 shows a block diagram of a modular computer system in

accordance with the invention consisting of seven modules, namely a base module 30, a multi-media module 31, a communications module 32, a storage module 33, a control module 34, an advanced graphics module 35 and a video module 36 (the last two may be combined if required). The base module 30 incorporates the power supply unit, the hard disk drive, the floppy disk drive, the floppy disk controller, serial and parallel ports and SVGA graphics. The system will support both the ISA and the PCI expansion bus architectures.

CLAIMS

1. A device module for detachable connection within a computer installation having a modular digital architecture, the device module incorporating a bus link and connection means for detachably connecting a plurality of such device modules together within the installation such that the bus links of the device modules are connected in series to form a digital bus system including sub-buses for supply of power to the device modules and transfer of control and data signals therebetween.

2. A device module according to claim 1, which is a universal module incorporating a power supply and any combination of a graphics interface, an audio system, an input device interface, a floppy disk drive, a hard disk drive, a CD ROM drive, a modem and a network interface.

3. A device module according to claim 1 or 2, which is a universal module incorporating a processor so as to form a basic personal computer (PC) or network computer (NC) when used on its own.

4. A device module according to claim 1, 2 or 3, which has a casing incorporating a lockable cover to prevent user access to the inside of the casing.

5. A device module according to any preceding claim, wherein the connection means is positioned such that, when a plurality of such device modules are stacked one on top of the other, the connection means of adjacent device modules are in register such

that the bus links of the device modules are connected in series by the connection means.

6. A device module according to any preceding claim, wherein the connection means comprises connectors on opposite sides of the device module so that a plurality of such device modules may be connected together to form a stack.

7. A computer installation having a modular digital architecture and comprising a universal module and one or more upgrade modules detachably connectable to the universal module by connection means, wherein each module includes a bus link such that, when the modules are connected together by the connection means, the bus links of the modules are connected in series to form a digital bus system including sub-buses for supply of power to the modules and transfer of control and data signals therebetween.

8. An installation according to claim 7, wherein the universal module and the one or more upgrade modules are connectable in series by the connection means such that the modules may be connected together in any order and in any combination of such modules.

9. An installation according to claim 7 or 8, wherein the universal module constitutes a basic personal computer (PC) or network computer (NC) when used on its own which is upgradable by the connection of one or more upgrade modules providing any combination of a processor, a floppy disk drive, a hard disk drive, a CD ROM drive, a modem, a graphics interface, an audio system and a network interface.

10. A digital bus system for interconnecting a plurality of device modules within

a digital computer installation, comprising a plurality of sub-buses adapted to be connected to the device modules and including a power sub-bus for supply of power to each of the device modules from a power supply unit, a control sub-bus for transfer of control signals between a common control unit and each of the device modules, a data sub-bus for transfer of data between at least some of the device modules, a standard communication sub-bus for transfer of standard communication signals between at least some of the device modules, and a fast communication sub-bus for transfer of fast communication signals between at least some of the device modules.

11. A system according to claim 10, which is divided into a standard channel and a fast channel provided at physically separate locations.

12. A system according to claim 10 or 11, wherein the sub-buses further include one or more of (a) an audio sub-bus for transfer of audio signals between at least some of the device modules, (b) a radio communication sub-bus for transfer of radio communication control signals between at least some of the device modules, and (c) an infra-red communication sub-bus for transfer of infra-red control signals between at least some of the device modules.

13. A system according to claims 10, 11 or12, which comprises a series of bus links each of which is constituted by a plurality of track parts arranged in parallel including a respective track part for each sub-bus, wherein each sub-bus comprises track parts of successive links connected in series.

14. A system according to claim 10, 11, 12 or 13, which supports any combination of communication between device modules by way of industry standard buses such as PCI, ISA, E-IDE, IIC, EVC, USB, AGP and 1394.

15. A digital bus system for interconnecting a plurality of device modules within a digital computer installation, comprising a plurality of conductive tracks arranged in parallel and connection means for detachable connection of the device modules, wherein the tracks comprise at least one track for each of (a) power supply signals to the device modules from a common power supply unit, (b) control signals to the device modules from a common control unit, and (c) communication signals to the device modules from communication means.

16. A modular digital computer installation comprising a series of individually cased device modules, each of which includes an integral bus link and integral connection means by which the device modules are detachably connectable in series without requiring use of any intermediate connecting link between adjacent device modules.

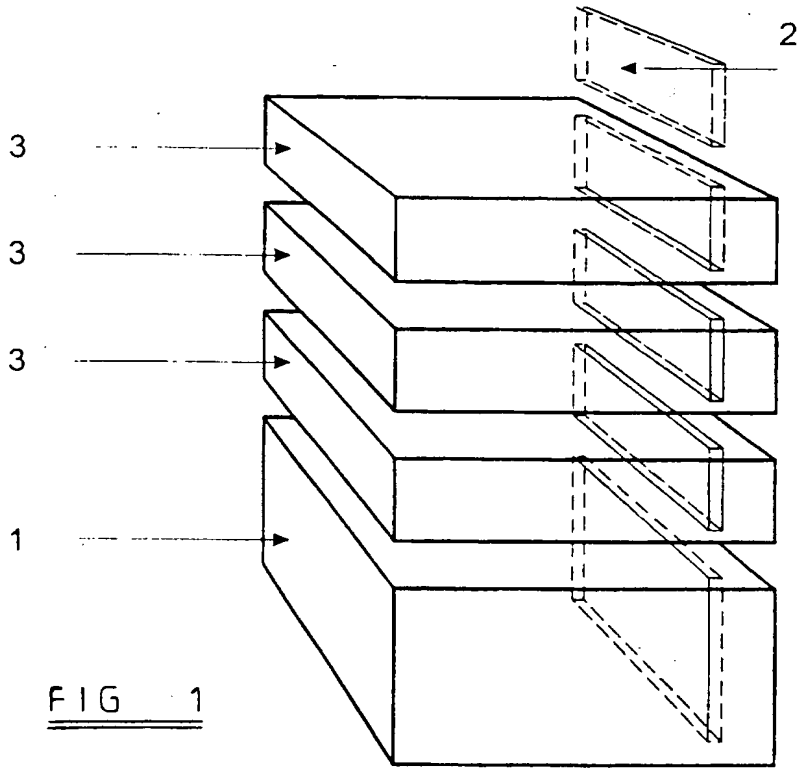


FIG 1

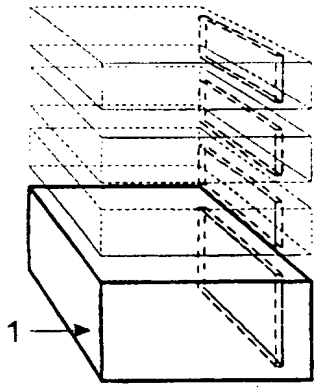


FIG 2

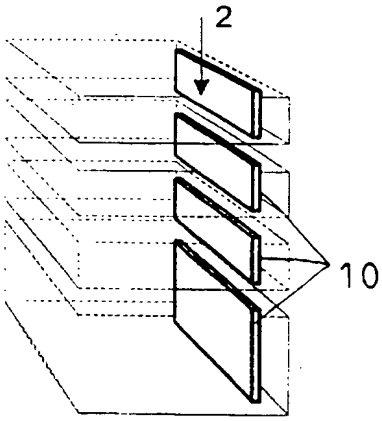


FIG 3

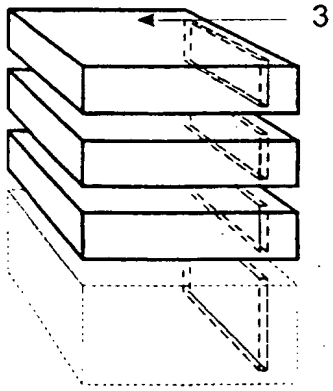


FIG 4

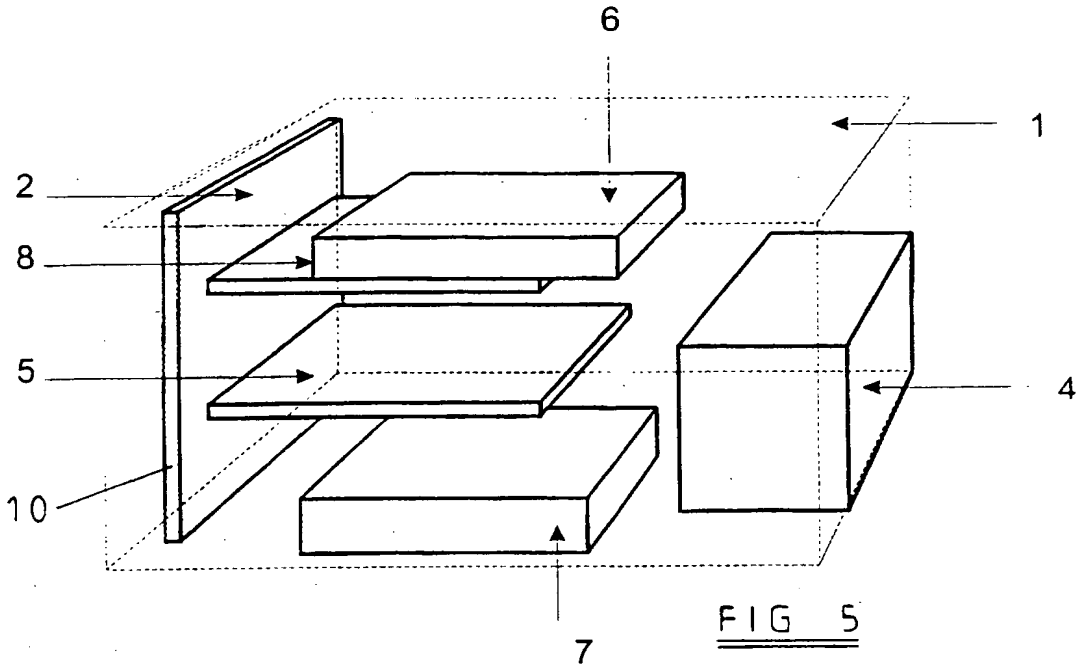


FIG 5

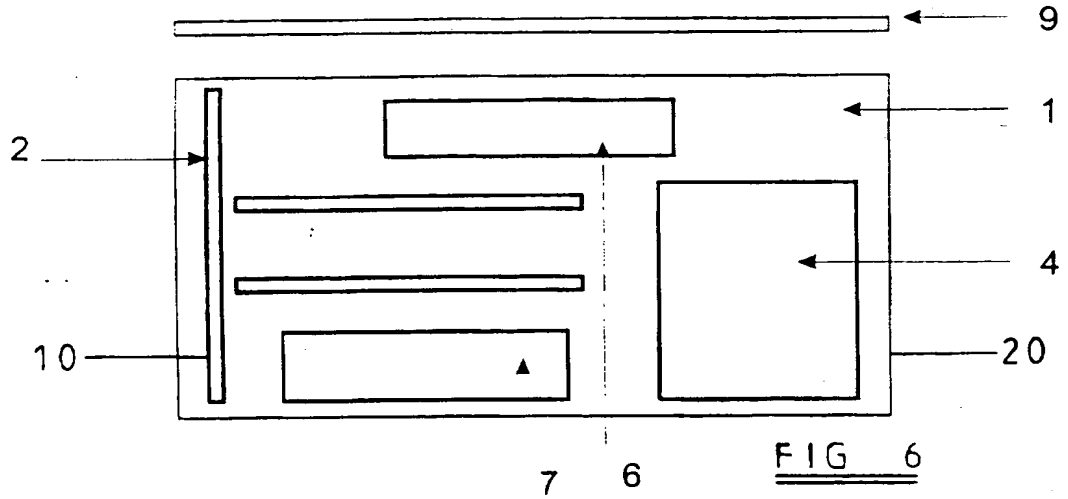


FIG 6

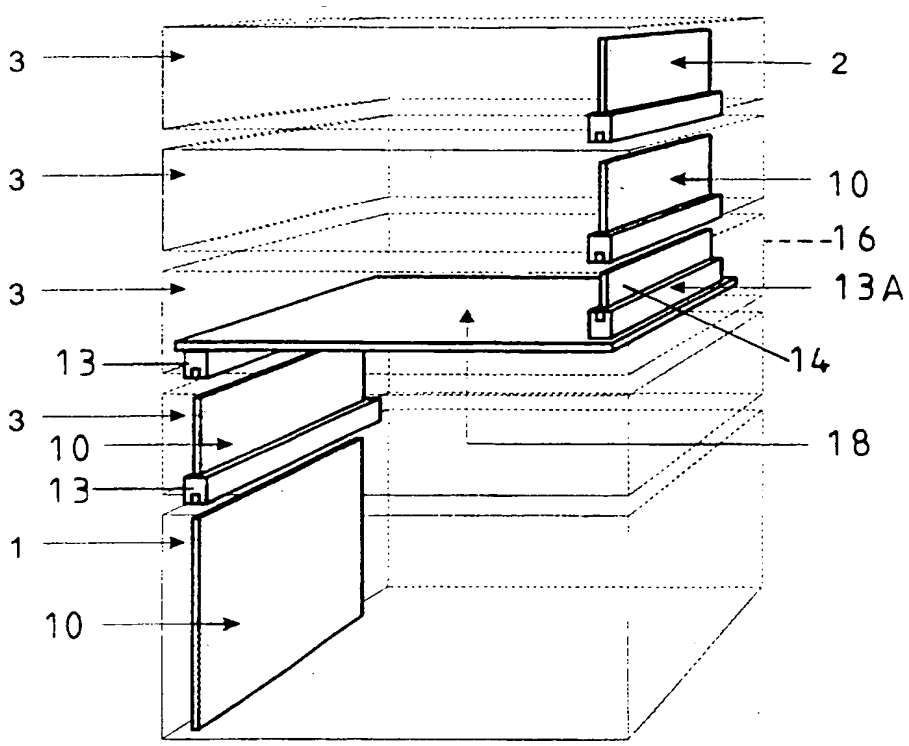


FIG 7

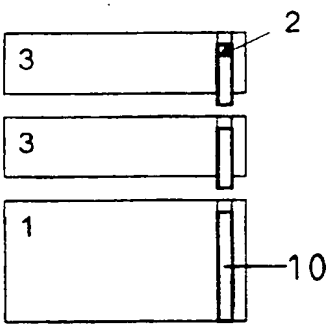


FIG 8

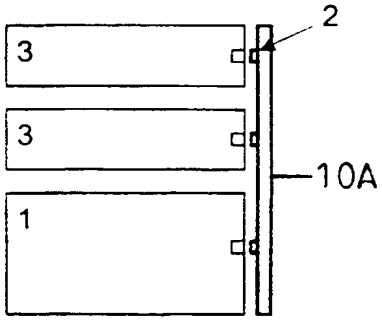


FIG 9

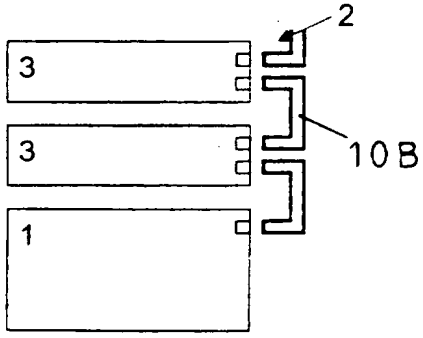


FIG 10

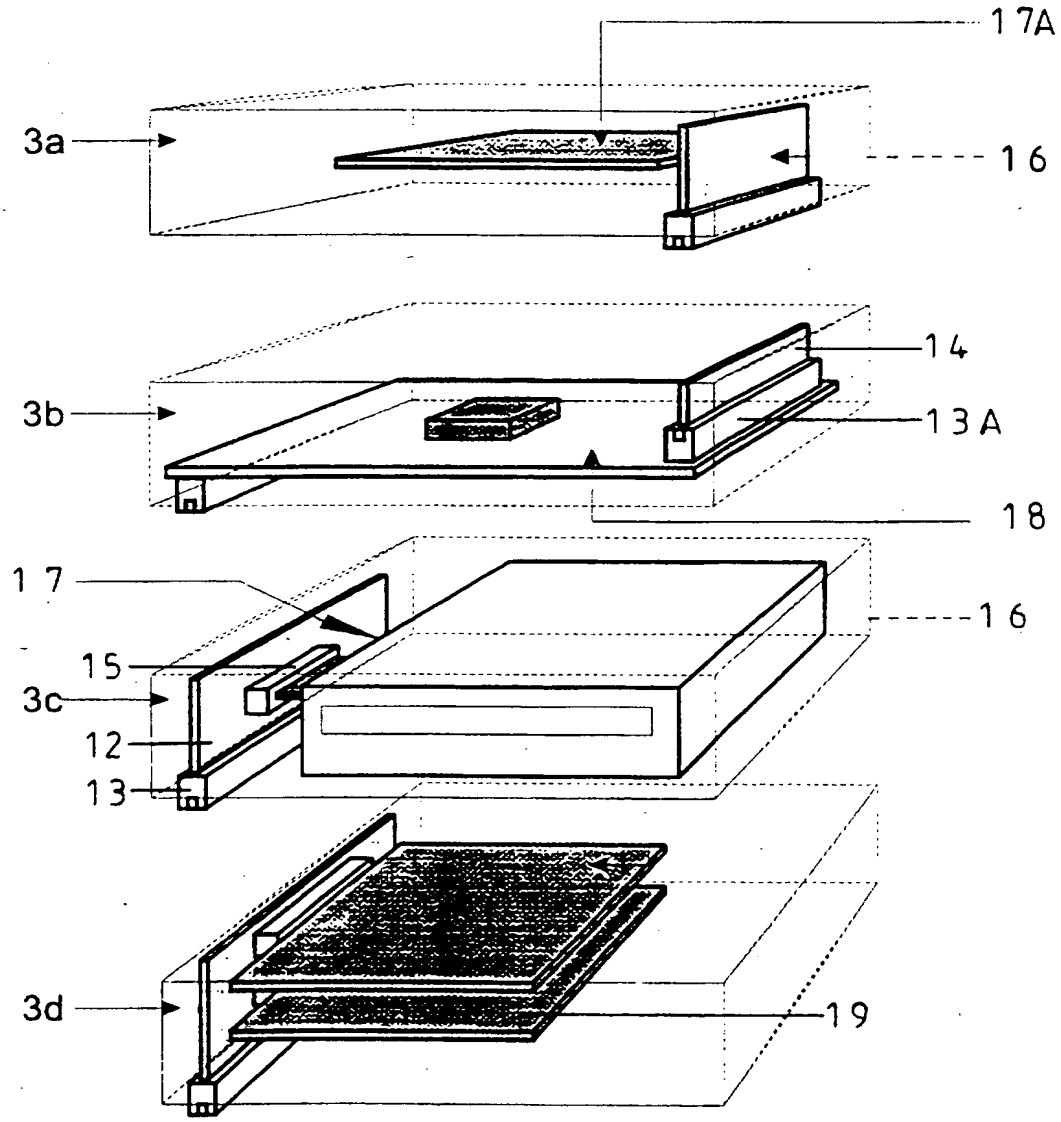


FIG 11

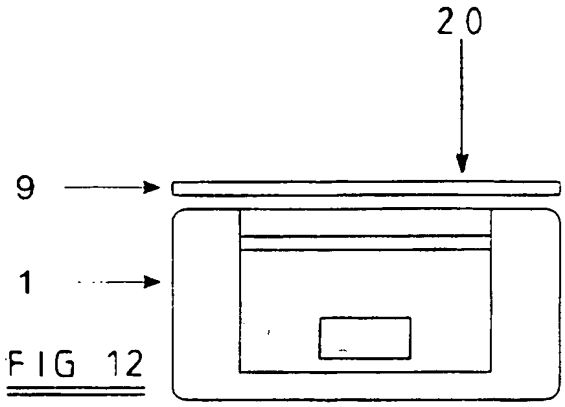


FIG 12

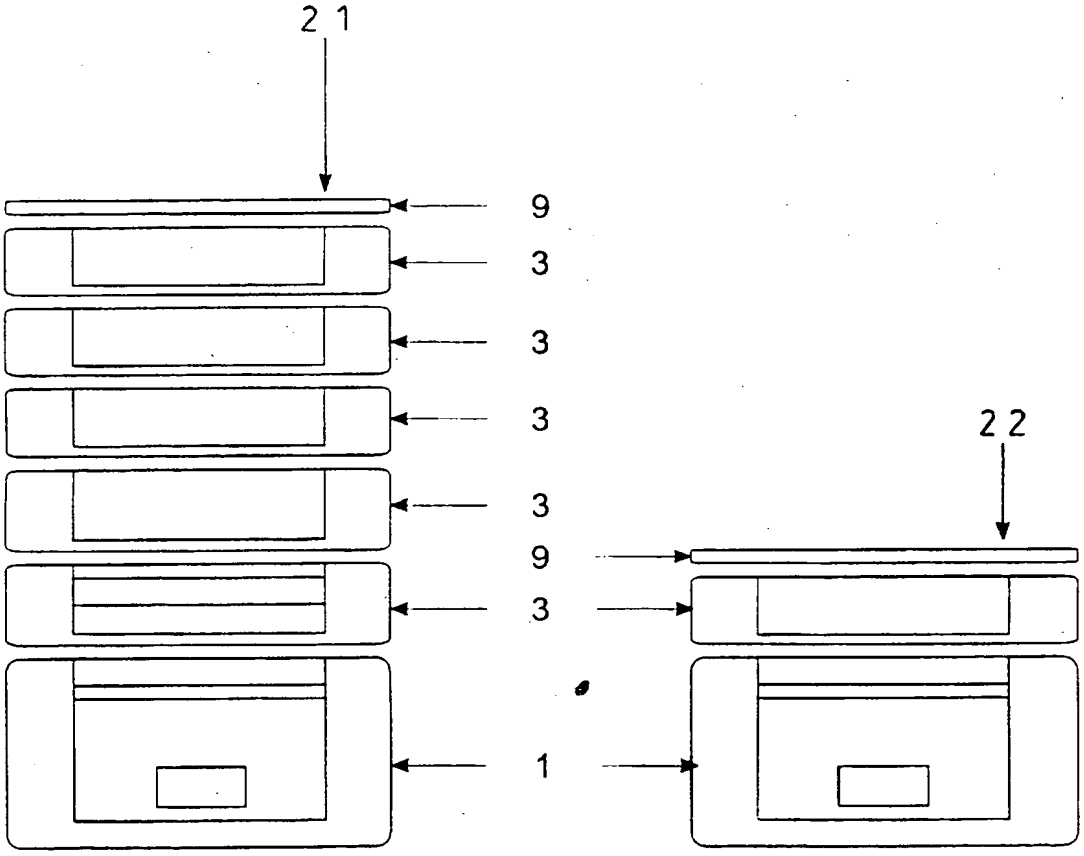
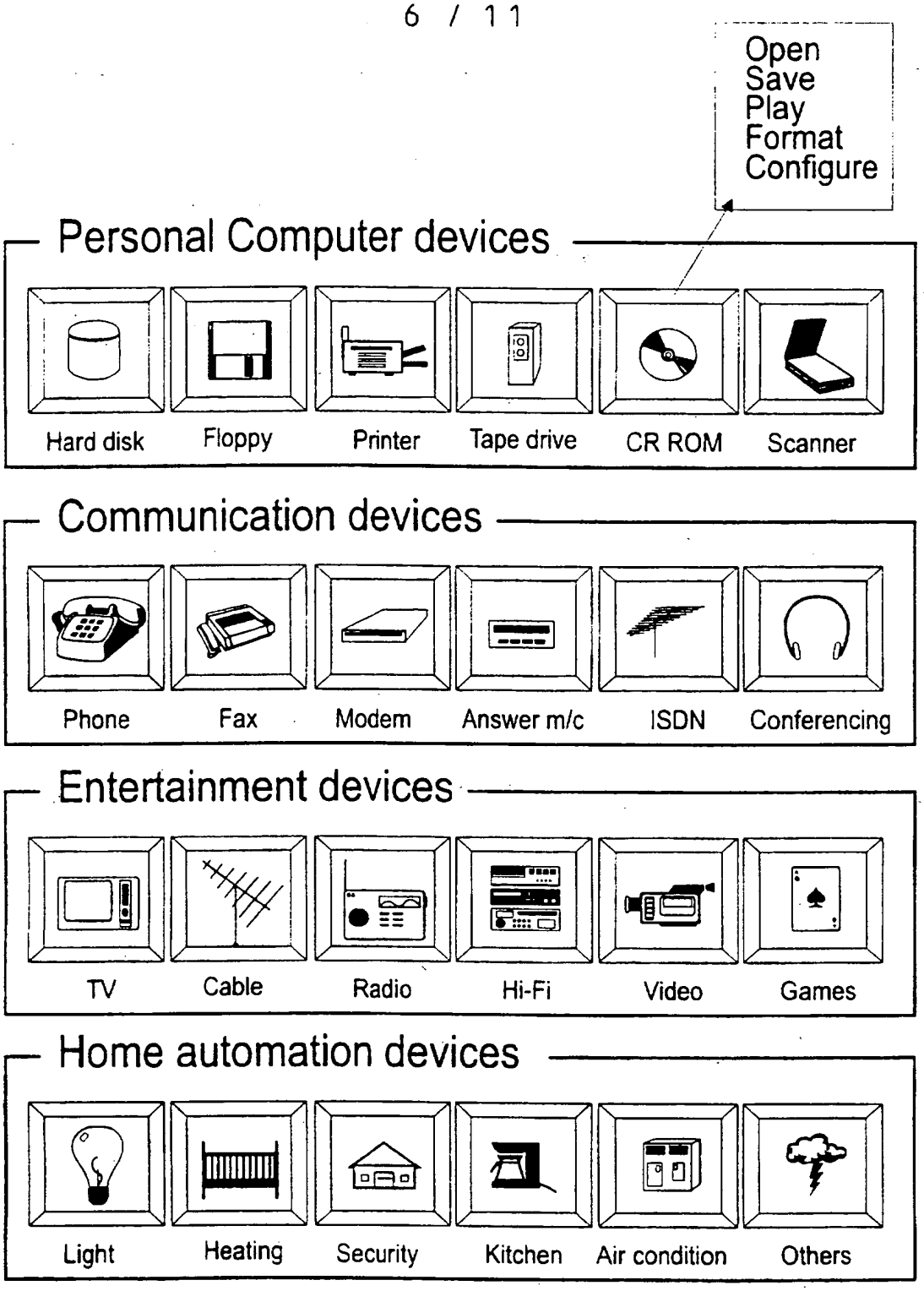


FIG 13

FIG 14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Conferencing
Entertainment devices
TV
Cable
Radio
Hi-Fi
Video
Games
Home automation devices
Light
Heating
Security
Kitchen
Air condition
Others

FIG 15

Standard Bus Side-Plane Connector 1

1	+12V	+12V
2	+12V	+12V
3	+5V	RESET_DRV
4	IO_CH_CK~	SD6
5	SD7	SD5
6	IRQ9	SD4
7	-5V	GND
8	DRQ2	SD2
9	SD3	-12V
10	+12V	SD1
11	GND	SD0
12	IDECS1A~	IO_CH_RDY
13	IDECS1B~	IDEADR0
14	IDECS3A~	AEN
15	IDECS3B~	SMEMW~
16	IDEADR2	SA19
17	GND	SMEMR~
18	IDEADR1	SA18
19	IDEINTA	IOW~
20	IDEINTB	IDEACKB~
21	IDEACKA~	SA17
22	IDERDY~	IOR~
23	IDEIORA~	SA16
24	IDEIORB~	DACK3~
25	IDEIOWA~	SA15
26	IDEIOWB~	DRQ3
27	IDEDRQA	SA14
28	+5V	DACK1~
29	IDEDRQB	SA13
30	IDATA0	DRQ1
31	IDATA15	GND
32	IDATA1	REFRESH~
33	IDATA14	SA12
34	IDATA2	SYSCLK
35	IDATA13	SA11
36	IDATA3	SA10
37	IDATA12	IRQ7
38	IDATA4	+5V
39	IDATA11	SA9
40	IDATA5	IRQ6
41	IDATA10	SA8
42	IDATA6	IRQ5
43	IDATA9	SA7
44	IDATA8	IRQ4
45	IDATA7	GND
46	IDERST~	IRQ3
47	+5V	SA6
48	GND	DACK2~
49	SA4	SA5

50	Connector key	Connector key
51	Connector key	Connector key
52	SA3	T_C
53	SA2	BALE
54	SA0	OSC
55	GND	PRDRACT~
56	PRICSEL	SA1
57	GND	+5V
58	SECCSEL	SBHE
59	+5V	LA23
60	MEM_CS16~	LA22
61	IO_CS16~	LA21
62	GND	IRQ10

FIG 16

Standard Bus Side-Plane Connector 2

1	IRQ11	LA20
2	GND	LA19
3	+5V	LA18
4	DACK0~	LA17
5	DRQ0	MEMR~
6	DACK5~	GND
7	GND	MEMW~
8	MSDATA	Reserved
9	DRQ5	SD8
10	MSCLOCK	Reserved
11	+5V	SD9
12	DACK6~	GND
13	KBDATA	Reserved
14	DRQ6	SD10
15	KBCLOCK	Reserved
16	GND	SD11
17	DACK7~	+5V
18	+5V	SD12
19	SPEAKER	DRQ7
20	SD13	GND
21	GND	SD14
22	MASTER~	SD15
23	+5V	+5V
24	PRIOVLD	Reserved
25	GND	GND
26	SECOVLD	Reserved
27	GND	+5V
28	SENSE1	Reserved
29	+5V	GND
30	Reserved	Reserved
31	GND	GND
32	I2C_SDA	I2C_SCL
33	GND	GND
34	Reserved	Reserved
35	GND	+5V
36	Reserved	Reserved
37	GND	GND
38	Reserved	Reserved
39	+5V	+5V
40	THRMOVL~	Reserved
41	Reserved	PSU_OFF~
42	GND	GND
43	Reserved	Reserved
44	Reserved	Reserved
45	+5V	P5VSB
46	Reserved	PWRGOOD
47	GND	GND
48	GND	LID_ON~
49	GND	LID_ON~

50	Connector key	Connector key
51	Connector key	Connector key
52	LEDPWR	Reserved
53	+3.3V	+3.3V
54	+3.3V	+3.3V
55	+3.3V	GND
56	+3.3V	+3.3V
57	+3.3V	+3.3V
58	+3.3V	+3.3V
59	+3.3V	+3.3V
60	GND	+3.3V
61	+3.3V	+3.3V
62	+3.3V	+3.3V

FIG 17

Enhanced Bus Side-Plane Connector 1

1	+12V	-12V
2	+12V	-12V
3	+5V	+5V
4	GND	GND
5	+5V	+5V
6	INTA~	+5V
7	INTC~	INTB~
8	+5V	INTD~
9	+5V	+5V
10	+PSIG	+PSIG
11	+PSIG	+PSIG
12	+PSIG	GND
13	Reserved	PCLK3
14	+PSIG	PCLK2
15	RST~	PCLK1
16	GNT0~	PCLK0
17	GNT1~	REQ0~
18	GNT2~	REQ1~
19	GNT3~	REQ2~
20	AD31	REQ3~
21	AD30	AD29
22	AD28	GND
23	AD26	AD27
24	GND	AD25
25	AD24	+3.3V
26	IDSEL0	C/BE3~
27	IDSEL1	AD23
28	IDSEL2	AD22
29	IDSEL3	AD21
30	AD20	+3.3V
31	AD18	AD19
32	AD16	AD17
33	+3.3V	C/BE2~
34	FRAME~	GND
35	GND	IRDY~
36	TRDY~	+3.3V
37	GND	DEVSEL~
38	STOP~	GND
39	+3.3V	LOCK~
40	SDONE	PERR~
41	SBO~	+3.3V
42	GND	SERR~
43	PAR	+3.3V
44	AD15	C/BE1~
45	+3.3V	AD14
46	AD13	GND
47	AD11	AD12
48	GND	AD10
49	AD9	Reserved

50	Connector key	Connector key
51	Connector key	Connector key
52	C/BE0~	AD08
53	+3.3V	AD07
54	AD06	+3.3V
55	AD04	AD05
56	GND	AD03
57	AD02	GND
58	AD00	AD01
59	+PSIG	+PSIG
60	REQ64~	ACK64~
61	+5V	+5V
62	+5V	+5V

FIG 18

Enhanced Bus Side-Plane Connector 2

1	GND	GND
2	C/BE7~	+PSIG
3	C/BE5~	C/BE6~
4	+PSIG	C/BE4~
5	PAR64	GND
6	AD62	AD63
7	GND	AD61
8	AD60	+PSIG
9	AD58	AD59
10	GND	AD57
11	AD56	GND
12	AD54	AD55
13	+PSIG	AD53
14	AD52	GND
15	AD50	AD51
16	GND	AD49
17	AD48	+PSIG
18	AD46	AD47
19	GND	AD45
20	AD44	GND
21	AD42	AD43
22	+3.3V	AD41
23	AD40	GND
24	AD38	AD39
25	GND	AD37
26	AD36	+3.3V
27	AD34	AD35
28	GND	AD33
29	AD32	GND
30	GND	+3.3V
31	Reserved	Reserved
32	Reserved	Reserved
33	Reserved	Reserved
34	Reserved	Reserved
35	Reserved	Reserved
36	Reserved	Reserved
37	Reserved	Reserved
38	Reserved	Reserved
39	Reserved	Reserved
40	Reserved	Reserved
41	Reserved	Reserved
42	Reserved	Reserved
43	Reserved	Reserved
44	Reserved	Reserved
45	Reserved	Reserved
46	Reserved	Reserved
47	Reserved	Reserved
48	GND	+5V
49	I2C_SDA	I2C_SCL

50	Connector key	Connector key
51	Connector key	Connector key
52	GND	LID_ON~
53	GND	LID_ON~
54	Reserved	GND
55	+5V	Reserved
56	Reserved	GND
57	P5VSB	Reserved
58	SENSE0	GND
59	SENSE1	Reserved
60	SENSE2	+5V
61	SENSE3	THRMOVL~
62	OVERL~	LEDPWR

FIG 19

Enhanced Bus Side-Plane Connector 2

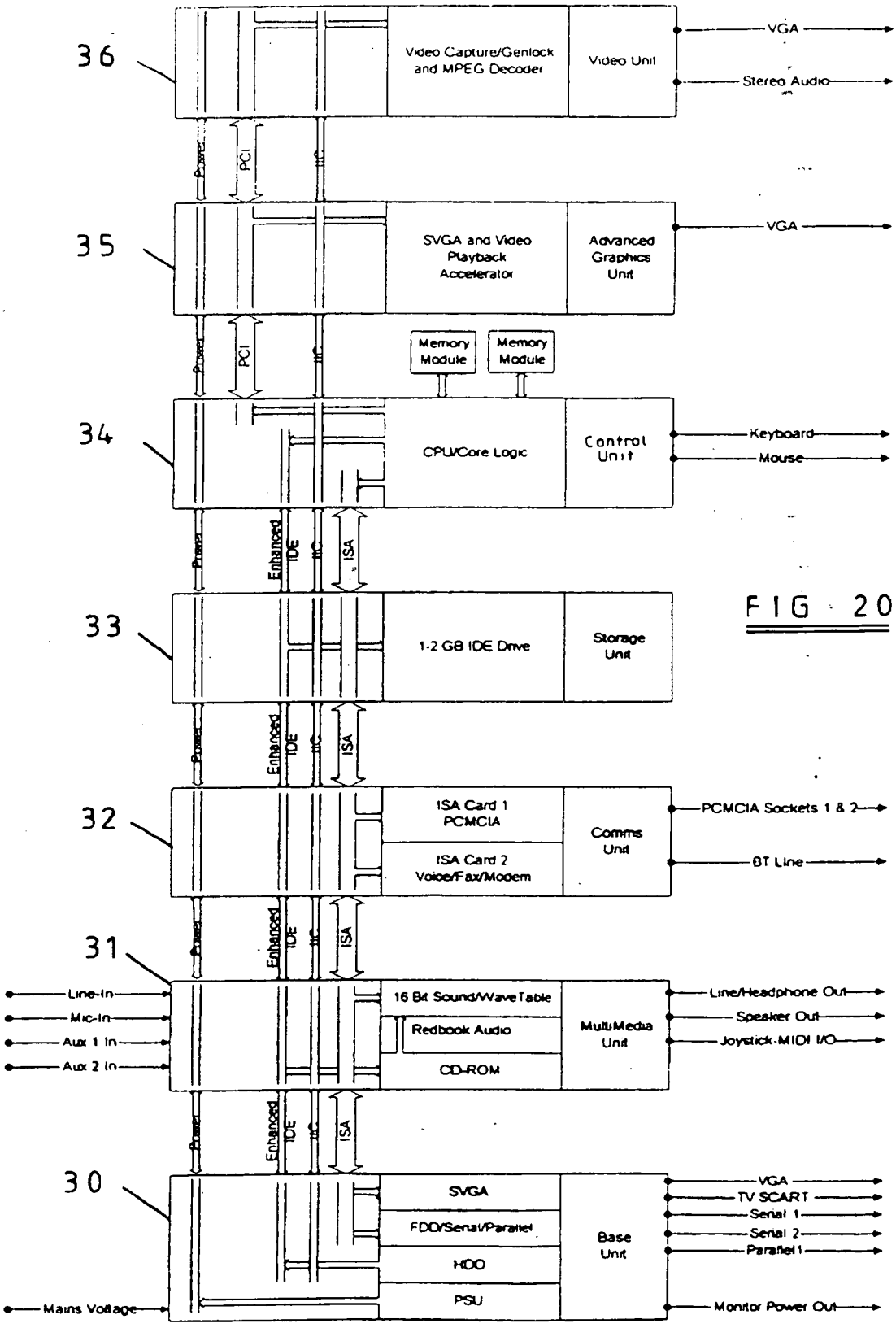
36
Video Capture/Genlock and MPEG Decoder
Video Unit
VGA
Stereo Audio
Power
PCI
I/C
35
SVGA and Video Playback Accelerator
Advanced Graphics Unit
VGA
Memory Module
Memory Module
34
CPU/Core Logic
Control Unit
Keyboard
Mouse
Enhanced IDE
ISA
33
1-2 GB IDE Drive
Storage Unit
32
ISA Card 1 PCMCIA
ISA Card 2 Voice/Fax/Modem
Comms Unit
PCMCIA Sockets 1 & 2
BT Line
31
16 Bit Sound/WaveTable
Redbook Audio
CD-ROM
MultiMedia Unit
Line-In
Mic-In
Aux 1 In
Aux 2 In
Line/Headphone Out
Speaker Out
Joystick-MIDI I/O
30
SVGA
FDD/Serial/Parallel
HDD
PSU
Base Unit
Mains Voltage
VGA
TV SCART
Serial 1
Serial 2
Parallel1
Monitor Power Out

FIG 20

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A3

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9526156.6 21 December 1995 (21.12.95) GB

(71) Applicant *(for all designated States except US)*: NEOSYSTEMS INC. [US/US]; Suite 1106, 260 Madison Avenue, New York, NY 10016 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: NEOMAN, Hany [IT/GB]; 147 Frimley Road, Camberley, Surrey GU15 2PS (GB). BARBER, Leonard, Reginald [GB/GB]; 14 Cedarwood, Kings Worthy, Winchester, Hampshire SO23 7RP (GB).

(74) Agent: HARDING, Richard, Patrick; A. R. Davies & Co., 27 Imperial Square, Cheltenham GL50 1RQ (GB).

(81) Designated States: GB, JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

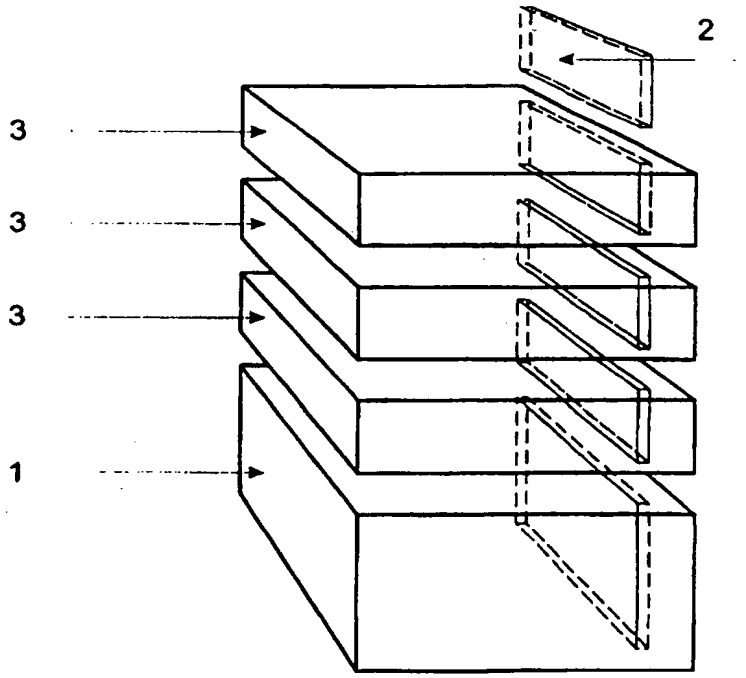
Published
With international search report.

(88) Date of publication of the international search report:
28 August 1997 (28.08.97)

(54) Title: MODULAR DIGITAL COMPUTER INSTALLATIONS

(57) Abstract

A computer installation having a modular digital architecture (MDA) comprises a universal base module (UBM) (1) and one or more functional upgrade modules (FUM) (3) detachably connectable to the UBM (1) by a modular upgrade bus (MUB) (2). The MUB (2) comprises a respective bus link within each module (1, 3) such that, when the modules (1, 3) are connected together, the bus links of the modules are connected in series to form the digital MUB which includes sub-buses for supply of power to the modules and transfer of control and data signals therebetween. Such an MDA can be used to produce a wide range of systems using the same basic architecture, such as a network computer (NC), a personal computer (PC) incorporating FUM's providing various PC features, such as an enhanced processor, a CD ROM drive, a hard disk drive, etc., or an appliance computer (AC) incorporating FUM's providing a range of appliance functions for the home, office or classroom, such as an audio system, an interactive television system, an office telephone system, a home security system, etc.. Furthermore the system permits straightforward FUM replacement or upgrade by addition of further FUMs without requiring any particular technical expertise.



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INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/GB 96/03110

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06F1/16 G06F1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 680 674 A (MOORE FERGUS E) 14 July 1987 see column 4, line 22 - line 57; claims; figures 1-5	1,2,5-8, 15,16
X	GB 2 105 115 A (SONY CORP) 16 March 1983 see page 3, left-hand column, line 14 - line 34; claims 1,2; figure 9	1,6-8,16
P,X	DE 295 03 748 U (WEDLICH RON ;WINKLER KLAUS G (DE)) 11 January 1996 see the whole document	1-3,5-9, 15,16
X	WO 84 04632 A (CONVERGENT TECHNOLOGIES INC) 22 November 1984 see page 3, line 34 - page 4, line 25; figure 1	1,6,7,16

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
4 March 1997	13.06.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	DURAND, J

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INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/GB 96/03110

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 295 11 005 U (PEACOCK AG) 14 September 1995 see the whole document ---	1-3,5-7, 9,16
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 28, no. 6, 1 November 1985, NEW YORK US, pages 2346-2347, XP002026859 "Stackable unit packaging concept" see the whole document -----	1-3,5-7, 9,16

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INTERNATIONAL SEARCH REPORT

rnational application No.
PCT/GB 96/03110

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos..
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

SEE ANNEXED SHEET

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-3,5-9,15-16

Remark on Protest

☐ The additional search fees were accompanied by the applicant s protest.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/210

1. Claims 1-3,5-9.15.16: Modular computer system composed of a series of modules linked by a common bus, each module comprising a part of the interconnecting bus.

2. Claim 4: Module comprising a lockable cover.

3. Claims 10-14: Digital bus system for interconnecting a plurality of modules and comprising a plurality of sub-buses including a standard communication sub-bus and a fast communication sub-bus.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ational Application No
PCT/GB 96/03110

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		WO 9702570 A	23-01-97